CLAIMS

1. A process comprising:

providing a wafer, the wafer comprising an inter-layer dielectric (ILD) having a feature therein, an under-layer deposited on the ILD, a barrier layer deposited on the under-layer and a conductive layer deposited on the barrier layer;

exposing the barrier layer;

placing the wafer in an electrolyte, such that at least the barrier layer is immersed in the electrolyte; and

applying an electrical potential between the electrode and the wafer.

2. The process of claim 1 wherein the conductive layer is copper.

3. The process of claim 1 wherein the barrier layer comprises ruthenium (Ru), rhodium (Rh), tantalum (Ta), iridium (Ir), osmium (Os), or alloys thereof containing nitrogen (N), silicon (Si) or carbon (C).

4. The process of claim 1 wherein the under-layer is titanium (Ti), titanium nitride (TiN), tungsten (W), tungsten nitride (WN) or tantalum nitride (TaN).

5. The process of claim 1, further comprising removing at least a portion of the under-layer using chemical mechanical polishing (CMP).

6. The process of claim 1 wherein the electrolyte has a pH equal to or greater than 10.

7. The process of claim 6 wherein the electrolyte comprises a solution of potassium hydroxide (KOH), sodium hydroxide (NaOH), ammonium hydroxide (NH_4OH) or tetra-methyl ammonium hydroxide (TMAH).

8. The process of claim 1, further comprising adding an additive to the electrolyte.

9. The process of claim 8 wherein the additive is an oxidizer, a corrosion inhibitor, a surfactant, a buffer, a complexor, or combinations thereof.

10. The process of claim 1 wherein the electrical potential has a value equal to or greater than 0.5V with respect to the saturated calomel reference electrode.

11. The process of claim 1, further comprising removing at least a portion of the conductive layer using chemical mechanical polishing (CMP).

12. A process comprising:

providing a wafer, the wafer comprising an inter-layer dielectric (ILD) having a feature therein, an under-layer deposited on the ILD, and a barrier layer deposited on the under-layer, and a conductive layer deposited in the feature;

placing the wafer in an electrolyte, such that at least the barrier layer is immersed in the electrolyte; and

applying an electrical potential between the electrode and the wafer.

13. The process of claim 12 wherein the conductive layer is copper.

14. The process of claim 12 wherein the barrier layer comprises ruthenium (Ru), rhodium (Rh), tantalum (Ta), iridium (Ir), osmium (Os), or alloys thereof containing nitrogen (N), silicon (Si) or carbon (C).

15. The process of claim 12 wherein the under-layer is titanium (Ti), titanium nitride (TiN), tungsten (W), tungsten nitride (WN) or tantalum nitride (TaN).

16. The process of claim 12, further comprising removing at least a portion of the under-layer using chemical mechanical polishing (CMP).

17. The process of claim 12 wherein the electrolyte has a pH equal to or greater than 10.

18. The process of claim 17 wherein the electrolyte comprises a solution of potassium hydroxide (KOH), sodium hydroxide (NaOH), ammonium hydroxide (NH_4OH) or tetra-methyl ammonium hydroxide (TMAH).

19. The process of claim 12, further comprising adding an additive to the electrolyte.

20. The process of claim 19 wherein the additive is an oxidizer, a corrosion inhibitor, a surfactant, a buffer, a complexor, or combinations thereof.

21. The process of claim 12 wherein the electrical potential has a value equal to or greater than 0.5V with respect to the saturated calomel reference electrode.

22. The process of claim 12, further comprising removing at least a portion of the conductive layer using chemical mechanical polishing (CMP).

23. An apparatus comprising:

a vessel having an electrolyte therein;

a first electrode at least partially immersed in the electrolyte, the first electrode comprising a wafer comprising an inter-layer dielectric (ILD) having a feature therein, an under-layer deposited on the ILD layer, a barrier layer deposited on the under-layer and a conductive layer deposited in the feature;

a second electrode at least partially immersed in the electrolyte; and

a potential source for applying a potential difference between the first and second electrodes.

24. The apparatus of claim 23 wherein the electrolyte has a pH equal to or greater than 10.

25. The apparatus of claim 23 wherein the electrolyte comprises a solution of potassium hydroxide (KOH), sodium hydroxide (NaOH), ammonium hydroxide (NH_4OH) or tetra-methyl ammonium hydroxide (TMAH).

26. The apparatus of claim 23, further comprising an additive in the electrolyte.

27. The apparatus of claim 26 wherein the additive is an oxidizer, a corrosion inhibitor, a surfactant, a buffer, a complexor, or combinations thereof.

28. The apparatus of claim 23 wherein the conductive layer is copper.

29. The apparatus of claim 23 wherein the barrier layer comprises ruthenium (Ru), rhodium (Rh), tantalum (Ta), iridium (Ir), osmium (Os), or alloys thereof containing nitrogen (N), silicon (Si) or carbon (C).

30. The apparatus of claim 23 wherein the under-layer includes titanium (Ti), titanium nitride (TiN), tungsten (W), tungsten nitride (WN) or tantalum nitride (TaN).

31. The apparatus of claim 23 wherein the electrical potential has a value equal to or greater than 0.5V relative to the saturated calomel reference electrode

32. The apparatus of claim 23, further comprising a reference electrode at least partially immersed in the electrolyte.

33. The apparatus of claim 32 wherein the reference electrode is a saturated calomel electrode.